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ADVANCED CONCEPT STUDIES FOR SUBSONIC AND SUPERSONIC COMMERCIAL TRANSPORTS ENTERING SERVICE IN THE 2030-35 PERIOD

NASA Research Announcement, Pre-Proposal Conference

1:00 p.m. through 5:00 p.m.
November 29, 2007

L'Enfant Plaza Hotel
Ballroom A/B
400 L'Enfant Plaza
Washington, D.C.

[TRANSCRIPT PREPARED FROM A DIGITAL RECORDING.]

C O N T E N T S

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P R O C E E D I N G S

Welcome

MS. CRISP: This afternoon, it is my job to remind everybody about the agenda, and it is a good one, but we are going to have a very interesting couple hours of discussion and feedback and Q&A.

During the Q&A session, if I can ask you to come to the mic, state your name and organization and then ask your question, that would be very helpful. If I could also ask you to return to your seat to write down that question, so that we can make sure that we share all of the Q&A of the conference.

So, to get started, it is my honor to introduce Dr. Lisa Porter, AA for Aeronautics at NASA, and she will provide some --

[Audio feedback noise.]

DR. PORTER: Sorry?

MS. CRISP: -- some information --

DR. PORTER: And some feedback.

[Laughter.]

MS. CRISP: -- about ARMD.

Introductory Remarks

DR. PORTER: Thank you. Well, good afternoon, everybody, and I want to thank you all for coming.

Let's see, an opening slide here.

Just a comment about the actual gist of why we are here and why we think these kinds of efforts are important and worthwhile. We hold these kinds of pre-proposal conferences as an opportunity for us to communicate to you, the community, what our thoughts are about an upcoming solicitation, and we want to hear from you today what you think about what we are telling you. We want to hear if you think there is clarification that is needed, if there is something that doesn't really make sense to you, if there is something you think is missing, and the reason we do this is because, ultimately, our goal is to put out a solicitation that makes a lot of sense, that is very clear, and that will allow you to write the best proposal that you can write. Obviously, that helps us get what we want, and it helps you get what you want. So it is a win-win situation, but it only works if you guys participate.

So this isn't just about us sitting up here and

talking and then you guys taking notes and leaving. That will have a minimal impact. What we really want is for you guys to come up and ask questions or just make comments, challenge us on things that you think need to be clarified or expanded upon or whatever. So, in just setting the tone, I want to make sure everybody feels energized and had a good lunch and maybe some coffee, so away we go.

Let me start off with a chart that I always like to start with when I talk about Aeronautics at NASA. I know some of you here have heard me talk about this before, but it is very important that everyone understands that everything that we do in aeronautics, in the Aeronautics Program, follows these three core principles. Every single decision that we make, every single program that we have, is going by all three of these principles, and there are no exceptions made to these principles.

So let me just take a moment to spend on each one of them. The first one says we will dedicate ourselves to the mastery and intellectual stewardship of the core competencies of aeronautics for the nation in all flight regimes, and there are a couple words I just want to emphasize.

The first one is mastery. When we talk about dedicating ourselves to mastery, we are actually making a commitment to two things. First, it means that we have to be committed to the cutting edge in research. If we continue to do what we already know how to do, then we will continue to solve problems in the way that we always solve them, and that does not enable us to do new things and solve new problems.

So that is a pretty obvious statement, but sometimes it is hard to stay committed to the cutting edge because what it means is you have to be willing to take on technical risk. Some people say that means you have to be willing to fail. From NASA's perspective, we don't really consider failure to be defined as a situation where you put something down on paper that you think makes a lot of sense, you have a plan based on everything you understand today about the state-of-the-art, you think it is going to work, you proceed with rigor, and then it turns out it doesn't work. We don't define that as failure. We define that as success because, if you have done it properly, you have learned. You have advanced your knowledge, and then you will probably be able to attack and solve that problem

going forward.

So we actually embrace technical risk in our programs and projects, and we see risk not as being contrary to success, but as a critical part of success.

Coupled with technical risk has to be technical rigor. You can't have one without the other. If you pursue technical risk without technical rigor, that is when you get into the realm of the ridiculous. So technical rigor requires the adherence of a scientific method and, therefore, adherence to peer review. We take peer review very seriously in our Aeronautics Program.

When we talk about 'for the nation' in that clause, we also take that very seriously because what that is saying is that what we do must benefit the community broadly. What we do must benefit the nation as a whole. We must advance the state of aeronautics for the nation as a whole, and that in turn means that we disseminate what we do for the benefit of those who have paid for it, the taxpayer.

So, taken together, the pursuit of mastery and ensuring that what we do benefits the nation as a whole, those two things mandate broad dissemination of our

research results to the widest appropriate and practical extent, which is in accordance, of course, with our Space Act, and of course, we adhere to national security and foreign policy when doing so.

But I emphasize this point because there are always continuing questions that come up about dissemination of research and whether exceptions can be made, and essentially, it is our policy and our philosophy and our principle that we disseminate for two reasons: one, because we have a commitment to the taxpayer to ensure that we get those research results out there; and two, because we have to ensure the quality of what we do is world-class, and the only way to do that is to get your results peer-reviewed. That is the only way to ensure quality research is to ensure that others who are not involved in your efforts have the opportunity to objectively review those results.

The second principle says we will focus our research in areas that are appropriate to NASA's unique capabilities. This is a very simple point, but it is one that also needs to be emphasized. We will not conduct research that is more appropriately conducted in the

private sector, nor will we conduct research that is more appropriately conducted by other agencies. So we don't conduct near-term incremental research here. We conduct research that is very forward-thinking, that takes on technical risk, that really goes for the revolutionary advancement. We go for the brass ring here at NASA.

The third principle states that we will directly address the fundamental research needs of NextGen in partnership with the member agencies of the JPDO. Now, hopefully, everyone in this audience has at least some familiarity with NextGen. If you don't and you plan to propose to this solicitation, you need to get smart about NextGen because everything that we do when we are talking about the future of aeronautics and the future of the aeronautics enterprise at NASA, we take into consideration what that NextGen vision is all about, and it is not just about air traffic management. It is about an aeronautics enterprise. It is about the air transportation system of the future in which air traffic management plays a central role, but so do the vehicles that reside in that air traffic management system. So those vehicles and the research that we devote to vehicles also have to be

considered in the context of the NextGen vision. So, for any of you who are not familiar with NextGen, you have got a little homework to do.

That leads me to my next slide. The research that we conduct at NASA -- NASA's aeronautics portfolio -- is governed by essentially three strategic documents. Two of them are national-level documents, and the third is an agency-level document.

The first one is the NGATS (or NextGen) Integrated Plan that was mandated in the Vision 100 language from 2003 congressional language which set up the Joint Planning and Development Office, the JPDO. Of course, NASA is a member partner in that, and as I stated, NextGen encompasses the revolutionary transformation of the airspace, the vehicles that fly in it, and their operational safety and their environmental impact. So, again, it is not just about the air traffic management revolution. It is about the air transportation system revolution, and the vehicles and the airspace together must be looked at as a coupled system.

The second document of extreme importance -- and I really hope you all are aware of this document -- is the

National Aeronautics R&D Policy, and its accompanying Executive Order. This was established last year, December of 2006. It was signed by the President. It is a very monumental document. It is the first time in the history of this country that the President has ever signed an aeronautics R&D policy, and the goal is extremely clear, to advance U.S. technological leadership in aeronautics by fostering a vibrant and dynamic aeronautics R&D community, and that community includes government, industry, and academia.

There are several principles in that policy that support that goal, and I list three there that are particularly relevant to the solicitation you are going to hear about today, where mobility through the air is vital to economic stability, growth, and security as a nation; assuring energy availability and efficiency is central to the growth of the aeronautics enterprise; and the environment must be protected while sustaining growth in air transportation.

The last document I will mention briefly is the strategic plan for the agency, for NASA. We also adhere to the strategic goals mentioned there, in particular, what we

call "Subgoal 3(e)" which is that NASA must advance knowledge in the fundamental disciplines of aeronautics and develop technologies for safer aircraft and higher capacity airspace systems.

I want to just take a moment to talk a little bit about how we view our partners in the community, how we intend to establish partnerships, and why we establish partnerships. This all flows from those three principles that I talked about earlier.

We look upon our partnerships as an important piece of our ability to enhance the state of aeronautics for the nation. NASA cannot do this alone, nor do we think that we can do this alone. We see ourselves as true partners, intellectual partners with industry, with academia, and with other government agencies, and we view partnerships as the way to foster a collaborative research environment in which the ideas and knowledge are exchanged across communities.

Again, we must ensure that we maximize the return on investment to the taxpayer who is our ultimate stakeholder. So every element of our portfolio targets innovative pre-competitive research that will advance our

nation's aeronautical expertise, and this gets back to the point that we don't conduct research that is near term and incremental and targeted to one or two particular special interests or a particular company's interest. What we do must benefit the broad community. We try to advance knowledge for the benefit of all who can take advantage of it and leverage it to their own unique capabilities and applications. So that is our role as the government, and we take that seriously. That is why we talk about pre-competitive research.

Finally, as I re-mention here, I just think it can't be stated strongly enough that, as I said, we will provide for the widest practical and appropriate dissemination of our results, and again, of course, always in accordance with national security and foreign policy.

I will talk just a minute about all of the programs within Aeronautics. Today, you are going to hear about Fundamental Aeronautics, and you are going to hear about a solicitation in the Fundamental Aeronautics Program, but we do have three research programs which are depicted here, and we have a fourth program called the Aeronautics Test Program.

The Aeronautics Test Program ensures the strategic availability and accessibility of a critical suite of aeronautical test facilities, that will be necessary for the advancement of aeronautics, both within NASA and within the broader national community.

In addition to that program, we have three research programs. The Fundamental Aeronautics Program conducts cutting-edge research that will produce innovative concepts, tools and technologies to enable revolutionary changes for vehicles that fly at any speed, and the Aviation Safety Program conducts cutting-edge research that will produce innovative concepts, tools and technologies to improve the intrinsic safety attributes of current and future aircraft, and finally, the Airspace Systems Program directly addresses the fundamental ATM research needs for NextGen by developing revolutionary concepts, capabilities, and technologies that will enable significant increases in the capacity, efficiency, and flexibility of the national airspace system.

Now, each of these programs in Aeronautics is extremely important, and we pursue them with great rigor and passion, but just as important to Aeronautics, to

NASA's Aeronautics Program, is the integration of these programs together, and the recognition that to truly advance the state of aeronautics for the nation, we need to work these programs together. We need to ensure that as we advance air traffic management capabilities, we advance them in concert with the vehicles that we envision that we will be operating in the airspace, and we cannot treat safety as an afterthought. Safety has to come first in our thinking, both in the vehicles that we design and in the airspace that they reside within.

So this is a highly complex and integrated problem, this aeronautics enterprise that we are trying to advance, that we are trying to revolutionize, and we all here, not just within NASA but within the community, have to think about the problem in that way, and it becomes very simple when you stop and think about what happens if you design the greatest supersonic aircraft that ever was, but you didn't take into consideration anything about the air traffic management system in which it has to fly, and then you find out that by forgetting to think about that, you could never fly it the way you had designed it.

So, conversely, what if you designed an air

traffic management system that really could handle two or three times the capacity of today's system, but only if all the vehicles look exactly the way they look today? So we don't want to be in that situation. When we talk about flexibility of a future airspace system, we are talking about, hopefully, a system that can accommodate a wide range of vehicles with a wide speed regime, with a wide capability regime, et cetera, and, of course, including the vehicles that you are going to hopefully be thinking about for this solicitation, the N+3, as the Fundamental Aeronautics Program likes to call it.

They like to use N-plus-X to note different generations of aircraft. The N+3 NRA, as noted here, is short for Advanced Concept Studies for Subsonic and Supersonic Commercial Transports Entering Service in about 2030-2035.

Now, you are going to hear a lot more about what they are looking for and what they are hoping to get out of the community in terms of thinking out of the box, looking long term, looking down the pipeline at the 2030-2035 time frame, but when you think about that, you have got to think about it in the context of what the NextGen vision is

telling you, which is that there is a demand that has been forecasted that says that anywhere between two to three times today's capacity is the expected demand of that system by 2025. So there is a whole paradigm that is being constructed around that forecasted demand, and if we are going to have vehicles that operate in that system effectively, then we are going to have to significantly reduce their environmental impact -- really, really huge decreases in environmental impact, both noise and emissions, and we are going to have to face the fact that these vehicles are going to have to address the fuel burn challenge that is looming large. So significant fuel efficiency improvements are going to be required.

But also, we would like to think about other elements of performance. Can we design aircraft that can have significantly reduced field length requirements because, if we can, perhaps we can open up new ways of using the airspace, of using airports that traditionally we don't think about flying large transport aircraft into, for example, and of course, we would like to think about being able to fly from here to California in half the time we fly today. Frankly, every one of us who has to do that

regularly really is looking forward to that.

So, with that, let me just turn it over to Dr. Alonso to set the stage further for the solicitation, but let me put my little plug in here. For those of you who want to learn more about aeronautics, we try to keep our website current. We try to keep things up there, and one thing that is very much of interest to the community is the information on our NRAs. We post awards very regularly, so you can know who is getting awards and what they are doing, and this is useful to you because you might actually generate interest in potential partners for solicitations like this if you get to know what people are being funded to do and the kind of research that is going on right now, and of course, we always have information about current solicitations, including this one, and we have a lot of other information on there as well, including our Aeronautics Technical Seminars, technical seminars we host regularly at Headquarters, and those are in podcast downloadable format. Believe it or not, they are actually pretty popular.

Please write that website down because it is not necessarily super easy to get to from NASA.gov. You've got

to remember that -- Aeronautics.NASA.gov. If you can remember that, you will find us real easily, and you will get all the information you need.

Unless there are any questions, I am going to turn it over to Dr. Alonso.

Oh, sure. Yes.

ATTENDEE: [Inaudible.]

DR. PORTER: Well, thank you for the question because we actually don't use the word "TRL" intentionally.

What we mean by fundamental research is research that spans anywhere from very foundational discipline-focused research in areas like materials and fluid dynamics, let's say, all the way up to fundamental system-level research, how do these disciplines integrate together, how do we take things from one piece and integrate it together to develop system-level capabilities. That is still fundamental research.

We don't talk about TRL because that is a very limiting way of looking at research. TRL tends to focus on a product. It has a useful context, but it is not very useful when you are talking about research.

So we talk about fundamental research, and thank

you for asking that because some people still get confused. It doesn't just mean foundational research. It includes foundational research, which is defined clearly in the policy, but it also includes research that integrates that foundational knowledge up to the subsystem and ultimately system level, and there are truly fundamental challenges at the system level that need to be pursued, and in fact, that is part of what the solicitation is all about. So that was a good lead-in question. Thanks.

Overview of NRA Solicitation

DR. ALONSO: Let me actually go through the meat of the solicitation. As Dr. Porter said -- and I would like to reiterate that right now -- we are here to tell you what our plans are for this solicitation that is to be released sometime in the middle of January, but we are here also to hear your feedback as to whether you think that certain things need to be clarified further or that certain goals need to be refined a little bit better before we actually put a solicitation out on the street.

So let me begin by sort of getting into it. You already saw the title, and the title was chosen carefully.

It was chosen as Advanced Concept Studies, because they are concept studies that we are looking for, for Subsonic and Supersonic Transports, Commercial Transports, not by accident, and then it is entering into service in the 2030-to-2035 time frame or time period. So all of those things in the title are actually important, and hopefully, we will try to clarify each one of those as we move forward.

The way we have set this up is that I am going to make some remarks that are generic to the entire solicitation that has two major components. One is the subsonic fixed-wing portion, and the other one is the supersonics portion. For each of those portions, one of the representatives from each of those projects will actually stand up and give you more of the details for those aspects of the solicitation.

We will call it NRA or N+3 NRA for short most of the time, rather than sort of setting out the whole title over there. It is here. This NRA is being put together for those two reasons that you actually see there, and I will repeat this later, but one is to ensure that we stimulate some innovation and some new thinking completely

out of the box about certain things that may be happening in airspace from the point of view of new vehicle concepts in the entering-to-service category of the period 2030-2035. So that is a relatively long time frame. It is not meant to be sort of an unbounded time frame of innovation for things that may happen sometime in their life span or something like this. It is very specifically targeted to that time frame.

Also, as Dr. Porter mentioned, we are very interesting in ensuring that aviation continues to be an engine for the economy in the United States and in the world, and the particular barriers that are being identified as we move forward for the growth of this aviation system are very significant. So, when we talk about performance and environmental challenges, you will see that they will take a first stage in everything that we actually say today.

Just as a preview, although I will repeat this later, this program is meant to be structured into a two-phased program, Phase 1 starting whenever we manage to award the first round of awards, sometime hopefully in the early summer. It will last for about a year. Phase 2 will

follow that and will be informed by the results of Phase 1 and hopefully will last anywhere between 18 months and 24 months. I will have more to say about these things in a moment.

So I am not going to discuss these charts, but these are the key charts that actually talk about the specific objectives for both the subsonic fixed-wing portion of the solicitation and the next one, the supersonic portion of the solicitation. Again, let me not talk about this, but just to tell you that subsonic fixed wing has been looking at N+1 and N+2 vehicles. That will be defined by Rich Wahls later on, and that we are looking at the N+3 generation of vehicles, which is the objective for this particular solicitation.

There is a big question mark in the bottom right corner of that slide because, although we do have some ideas of what these concepts may actually look like, frankly, it is really up for grabs, and that is why we are trying to motivate the thinking here.

The same thing goes for supersonics. You will see that N+1 and N+2 goals that Peter Coen will speak about, and then you will see the N+3 goals with a big

question mark attached to the bottom right corner picture that you see there. Again, let me not deal with the specifics of the numbers that you see in those charts. The two charts will appear later on in the presentations and will be discussed in more detail.

Again, to set the framework for this whole thing, we have been talking about this now for a few months, and we have had some discussions with various people. One of the questions that often comes up is why N+3 and why do it now. Frankly, when we look at some of the efforts for N+1, which is essentially generation after the airplanes that are hitting the street right now, all the concepts are maturing, and a number of aircraft companies have been working on these concepts for years already.

When you look at N+2, which at NASA we believe for subsonic fixed wing, for example, may take a form of a hybrid wing body-type vehicle, well, if you look at the history of publications, NASA started doing some of this work jointly with a number of the folks that are here in the audience back in the 1990 time frame. So we have been at it for about 17 years, although there are many hurdles to be overcome for those vehicles to actually become a

reality. There is a certain body of work that has already been done.

So we felt that the N+3 NRA seeding some of the ideas and the concepts that in the next few years NASA and the nation were actually working on was an interesting idea. It is also important for us in Fundamental Aeronautics and the ARMD to have a balanced portfolio.

Dr. Porter told you that we are pursuing cutting-edge research. Well, cutting-edge research means that you do have to invest some of the old portfolio in things that are quite advanced and that have a high level of risk, but a high potential payoff as well and what you can learn to actually mature the concepts of the aircraft that are going to be entering service in this period. So that is the main rationale.

So we are trying to stimulate thinking to look at potential aircraft solutions that solve significant problems for the future, and this is in performance, environmental, operations capacity, so on and so forth. Again, I will stress this towards the end of my presentation, but this is not just an aircraft design-type exercise or a conceptual design that looks just at some

particular mission and sort of attempts to put together a concept that satisfies those mission requirements. Rather, this is a process that is vehicle-centric, but is actually meant to be informed by the safety issues and the air traffic management issues that were discussed before.

We are interested at NASA in looking to the future at some of these concepts and identifying some of the key technologies that may make these concepts a reality. So, when we look at these things, we do it for a selfish purpose, and that is that as we move forward, we want to be well informed as to what is it that are the set of technologies that NASA ought to be investing in for the future aeronautics in the nation.

Frankly, I said this before, but as we move forward, the last thing we want to do is sort of exhaust the ideas that we started to work on 10 years ago and then find ourselves in a point where new ideas are not forthcoming. So we are just priming the pipeline for future developments.

Logistics of the entire solicitation within specific aspects in subsonic fixed wing and supersonics. Phase 1 is a series of concept studies. It is meant to

last 12 months. So, again, as you will see or hear later from Vicki, we will hopefully have awards in place by early summer, which means we will start in June of 2008, and by June of 2009, we want to have a number of concept studies in place.

The expected investment for Phase 1 for that whole year is about $10 million, and we are estimating at the moment a number of awards that is possibly around five awards, possibly three subsonic and two supersonic, but frankly, these are our estimations at the moment. The number of awards that get awarded is going to depend heavily on the quality of the proposals that come in and the responsiveness of some of those proposals to the actual goals of the solicitation. So this is our current thinking that we are letting you know about that there may be some changes on this.

After Phase 1 is completed, we hope to enter into a Phase 2 which will take anywhere between a year and a half and two years. The details, we have a rough idea, but they are not going to show a lot because they are going to depend largely on the outcome of Phase 1, and on the progress of Phase 1 as the first year is sort of being

worked on, we envision that there will be a down-select procedure between the five concepts or sub-concepts that are funded in Phase 1 and the ones that are carried forward in Phase 2.

We envision that there will be some continued work to refine those concepts during Phase 2, but we also envision that the Phase 2 program will have a significant component of technology experiments for those key areas where the concept side that I have identified that additional work is going to be needed.

You will also see that throughout the presentation and my colleagues' presentations here, you will hear some really aggressive targets for the N+3 sets of vehicles, and we are fairly aware of the fact that these targets are extremely aggressive. We also are aware of the fact that it is going to require close interconnection between the traditional disciplines and the conceptual design for a particular vehicle to even get close to reaching some of these goals. So that is why you will see several times through the presentation that teaming is particularly encouraged for these types of studies because we believe that the solution is not just going to be found

with an airframe or an engine or some particular technology, but rather through the integration of all of these ideas.

So, again, as we move forward, Phase 1, which I am going to focus on right now, is supposed to be a series of conceptual studies. I think most people probably understand what we mean by a conceptual study, but we did want to clarify, and in particular, before the solicitation comes out, in your packets that you were handed out today, you will actually see a little document that expands a little bit on these ideas. You can read that and then read the solicitation, obviously, but we want to make sure that given the set of requirements, which we are going to be providing to you -- and you will hear about these soon -- that your work throughout the course of that first year in Phase 1 identifies a concept or a series of concepts that go a certain distance towards meeting those requirements.

Again, because the requirements will be so aggressive, there is probably very little chance, unless you surprise us and you come up with some very good ideas, that you are going to meet all of those targets simultaneously. So that is why when I say concept or

concepts, we are also interested in learning about the trades between the different targets that we are specifying for you as a result of the studies that you will be tackling during Phase 1.

One important thing -- and Dr. Porter mentioned this -- as we move forward, we want to make sure that the result of research that is funded through the NRA is wide and open. So we are going to ask if the details of these configurations are actually things that can be put together in a technical report and that shall be published. This is actually very important to us. I will emphasize that again later on.

This has been mentioned as well, but I will say it again. It is a vehicle-centric type of design, but if you are not informed by what you think and what we think and what others think that the NextGen is going to be looking like in 2030 to 2035 when these vehicles would enter into service, then you are probably going to be missing the boat somewhat.

So, in putting together these conceptual designs, you are going to have to keep an eye on what is going on in the development of NextGen. You have to project what you

believe the air traffic system is going to be looking like then, and of course, it is not just airspace and the vehicles, but also, you are going to have to be mindful of the safety issues that may arise from introducing these new vehicles that you are discussing.

I said plus solutions. We don't want to see the tables for N+3, a single concept vehicle that meets everything. We would like to hear from you about alternatives that target one or two of the efforts more than the others. So we are looking forward to hearing that.

Now, when I say conceptual-level study, I just made a note to myself here that I would like to bring up. We really are looking at the first-order design drivers for these types of concepts and would like to have answers with roughly plus or minus 10 percent accuracy in the types of disciplines that we are going to be looking into.

This is important because in doing that, we are not just looking at these very revolutionary concepts for you to do a conceptual study based on, let's say, statistical databases for a number of airplanes that have been built in the past that probably have nothing to do

with the types of concepts we are going to be putting together.

We look at these concepts and we want these plus or minus 10 percent, roughly, error bars on the solutions that you are going to be providing, as concept studies are going to have to have a mixture of low fidelity, medium fidelity, and maybe some high fidelity tools that actually are used in the critical areas where those things are needed.

Collaborative efforts strongly suggested, again, this is up to you. We won't turn down a proposal that actually is not collaborative. If you think you don't have to do this collaboration, well, then you are welcome to propose like that, but we want to see that, indeed, there is enough representation from the multiple disciplines and portions of the conceptual design that may make those vehicles a reality.

As we were discussing the N+3 solicitation, we also were trying to consider that, well, people are going to be asking what technologies are in and what is out. Is an electric airplane something that you are interested in? Is cold fusion reactors in the airplane on board to power

the whole thing something you are interested in?

We did not want to explicitly say this is in and this is out. Certain things are mentioned in that little draft summary that I told you about a minute ago, certain things that we mentioned in the solicitation, but we want to make sure that as you move forward in putting certain events, technologies into your conceptual designs, they pass what I call the "test of reasonableness." How reasonable is it that these technologies may actually be available for an entry into service in the vehicle between the 2030-2035 period? So you will have to use some of these things. Obviously, we are not going to tell you, yes, this is out, this is in, but we would like you to keep in mind that time frame. So we are putting that up there because it is a long time, as I was mentioning before, but we want it not to be way far-fetched, I would say.

Critical criteria metrics for proposal evaluation will be described in the solicitation. That is some of the standard things that you have seen in many of our NRAs in terms of reasonableness of the approach, technical merits, so on and so forth. So you will hear more details about that, and then before I just wrap up with the next slide, I

would say that there are two sheets somewhere in the back of the room for signups, for one-on-one meetings after the full question-and-answer period. So, if any of the folks or the institutions that are represented here today would like to meet with either the supersonics or the subsonic fixed-wing groups or both, you are more than welcome to sign up for some of those time slots. So please see Leslye at the registration desk. So please feel free to do that.

We realize there is only a limited number of slots, but if there is more interest than we have slots available, we will make sure that each of the teams actually schedule some telecon time in the next week to discuss these issues with you, so that we can accommodate everybody.

Last comments from me before I turn it over to Rich Wahls, we want to have you think out of the box in this. So I am giving you the constraint of 2030-2035 and beyond that and that test of reasonableness in the technologies that may be represented, we want you to come up with certain things. We want you to look around and find out what technologies may be available. We want you to sort of push the envelope, get out of your sort of level

of comfort, and actually come up with some ideas that really force you to think out of the box.

These are, in some senses, exploratory studies. We are funding a number of studies because we want to populate the design space somewhat to try to achieve the goals that we will be describing in a minute. So some freedom is both required and I think it is warranted and it is definitely allowed. So think of that. Don't think that NASA is just looking at this sort of particular evolution of what NASA has on the plate right now. We really want you to think differently. You will hear the same message from both Rich Wahls and from Peter Coen on this.

Finally, we are looking forward to your feedback and your questions, and we are looking forward to refining the solicitation, so it can hit the street in mid January, and we can sort of move forward.

My last slide is to show you the same one that Dr. Porter showed you, again. We are going to be focusing on the Fundamental Aeronautics Program and sort of the vehicle concepts, but they need to be informed on what is going on in the other two areas that are represented on that slide.

We will take questions at the end, but since we did stop before with Dr. Porter, I will just take some questions before I introduce the next speaker.

Yes. Do you mind using the microphone?

ATTENDEE: I am representing industry, so industry kinds of questions. You used the term "studies." Industry, the deliverable for the study program is paper, a report. Is that correct in this case, or are you looking in addition to demonstrations?

DR. ALONSO: In Phase 1?

ATTENDEE: Phase 1.

DR. ALONSO: Phase 1, the outcome is going to be a report. You will hear it from the presenters, all the details of the study and the alternatives that have been evaluated, so on and so forth.

ATTENDEE: You mentioned that there was approximately $10 million. Does that $10 million cover the internal NASA involvement as well, or is that $10 million that is available for external funding?

DR. ALONSO: This is an NRA. So it is $10 million of external funding.

NASA will conduct some small studies within

house, but they will be from a separate source of funding.

ATTENDEE: My last question, are you allowing NASA organizations to participate as team mates with industry or academia as well?

DR. ALONSO: Good question. No. This is an NRA. So it is structured as a normal NRA. We are welcoming the potential participants to use NASA-developed tools, for example. We welcome you to look at some of the things that are being developed within this time frame of performance that you may be able to use.

We will talk about collaborative efforts. So, after the proposal is awarded, we would like to make sure that NASA folks are involved in following the activities of your own conceptual designs, but we are not allowing teaming arrangements between, let's say, a proposor and NASA centers or groups of researchers to propose to the NRA solicitation.

ATTENDEE: Thank you.

DR. ALONSO: After proposal, we definitely encourage a lot of the interaction.

ATTENDEE: Okay, thank you.

DR. ALONSO: Thank you.

Other questions before we go into some of the details?

[No response.]

DR. ALONSO: Why don't I introduce Dr. Rich Wahls who is the project scientist for the Subsonic Fixed-Wing Project, and Rich is going to give you some of the details that are specific to the subsonic wing portion of the solicitation.

Rich?

Details of Subsonic Fixed-Wing Portion of the Solicitation

DR. WAHLS: First of all, I want to send regrets from Fay Collier, the PI. He wanted to be here, but he is attending the funeral of his grandmother right now. So you get me instead. I will try to be Fay.

This is the perspective of the subsonic fixed-wing part of this solicitation. I am going to start with a couple charts on the background of the project in general, the objectives. You can read what I have up there, development of prediction and analysis tools for reduced uncertainty in the design process. The key part there is tools and with uncertainty with tools. The second

primary objective is development of concepts and technologies for enabling dramatic improvements in noise, emissions, and performance characteristics, so concepts and technologies, technologies that go on airplanes, airplane concepts.

This solicitation definitely centers on the second of those two objectives. Previous NRAs have focused a good bit on improving tools and methodologies, and tying them to advanced concepts. The N+3 NRA swings the other way definitely on the concept side. Using existing tools, you could use new tools as they evolve, but definitely concepts.

The relevance of the project ties we hope to impact future designs on a wide range of subsonic fixed-wing vehicles, and we may have focused efforts on certain classes of vehicles, but the tools and technologies will often pertain to other classes of vehicles as well.

We have heard this today already, the JPDO, the NextGen work that is going on, defining the NextGen air transportation system is key, and so we are trying to have impact on that via the vehicle technology primarily.

This is a chart where Fay does a really good job

of talking about it. It introduces the N+1, the N+2 definitions and the idea of corners of the trade space.

Corners of the trade space. We have talked about noise, emissions, and performance. This kind of lays out some numbers for you, the aggressive goals or metrics that Juan alluded to. In any of these time frames if one could meet all the goals, that would be outstanding, but the truth is we understand the market drives the vehicles. A lot of things drive the vehicles, and so what we are really about is wanting to enable the trades, enable the people who make the vehicles have a higher confidence in their trades and confidence in the technologies to integrate into them.

So noise is tied to Stage 3 and progresses left to right and gets progressively tighter. I will show the N+3 numbers as they stand right now in a moment. The landing, takeoff, NOx emissions, also pretty aggressive goals related to the CAEP 2 (International Civil Aviation Organization's [ICAO] Committee on Aviation Environmental Protection) standards. Performance. We break that down into two areas. The primary one, the historical one has been fuel burn, reducing fuel, fuel costs, for cost and

environmental reasons.

This chart here is slightly different. It is a slightly updated version from the one in the handout based on some comments that Dr. Porter gave Fay in part a few weeks ago. He wanted to make sure Dr. Porter noticed a few changes on this.

The change deals with the part of the fuel burn. Before, we were trying to take some credit for some low-hanging fruit in the operational area, like continuous descent, terminal area, taxiing, saving fuel burn that way, and that is not so much in the purview of subsonic fixed wing as it is in some of the other projects, and it pertains really across all the generations. So we pulled that down on the bottom as a 10-percent.

In the fuel burn line, there is engine technology. There is airframe technology. There is materials, aerodynamics. All of the disciplines feed into these. Laminar flow is a big part of this, the Holy Grail of drag reduction. It is part of all two of these columns, and I would expect it would be on a third -- enabling practical, reliable laminar flow on a large vehicle.

The second part of performance is field length,

and that has to do with being able to get in and out of smaller runways. There is a progression of characteristics along that. We will talk a little bit more about that when we get to the N+3.

So, for N+1, that has been talked about as a 2015 entry into service, kind of a next generation single transport-type vehicle. We use a 737 as a reference on that, and the N+2 shows a 2020 IOC. In our mind, it is tied more to maybe the deployment of a new larger military-type vehicle, but there is dual purpose in there for civilian larger vehicles as well. We reference that to the 777.

Down at the bottom, it talks a little bit about the approach, and some key things there are when we say vehicle, we mean vehicle. It is not just the airframe, and it is not just the propulsion system. It is both of them and all the subsystems together in a vehicle. So we have to work all parts. That is why I probably see such a wide range of folks here, as I would expect.

Continually trying to reduce the uncertainty in the design and analysis process is an overall goal. Developing, testing, analyzing, verifying tools and the

technologies as an approach, and we have some very foundational research across all the disciplines that in the long run will feed into 2020, 2030, 2040, that if we don't do it, we will be wishing we had, come down the road.

This next chart is a chart that I pulled from the NextGen integrated plan from 2004, and I was reminded of it in New Orleans at the talk by Carl Burleson from the FAA. I really like this. A lot of what we are talking about today is projecting the future. You can see studies, a lot of different studies, and in general, you see two to three times increase in demand over the next 20, 25 years. Pick your number.

What this chart goes to is it shows two things. Number one, it is going to increase. Something dramatic would have to happen for it not to increase, but there is uncertainty in how much, and this increase has to happen while protecting the environment. So there is going to be more demand, and overall, the effect on the environment has to do down. Everybody knows that is a super challenging problem.

On the low end of the spectrum is the theory that larger vehicles, like the A380, become predominant. So you

are meeting the capacity of demands by putting more payload on vehicles. In the upper end, it says you are going to fly fewer people on a lot of smaller vehicles, and somewhere in the middle, it is probably more like what we have today.

Part of what we are going to ask that you do, we have said it is a vehicle-centric study, but you are going to need to place your vehicle concept in a context, and you could pick kind of anywhere in that range and convince us that that is the right thing to do. So we are trying to allow freedom here and solicit as many ideas as we can get.

The N+3, this is where the corners of the trade space, N+3, comes out. 2030-2035, entry into service, a commercial vehicle is what we are envisioning. We are definitely talking about commercial vehicles, passenger-carrying or package-carrying type of vehicles.

We picked as a reference vehicle here, a 737 again because that class of vehicle, the 727/37s, are the most prevalent in today's fleet. So you will see later. One of the questions when I think about this, I think we are asking you to project the future and identify by the middle of this century what will be the most prevalent

vehicle concept out there. It might be the same size as the 737. It might be smaller. It might be larger. Who knows?

Down at the bottom is a question mark. I almost put "Your Concept Here." We don't know what that is.

The noise metric, again, I will repeat. These are corners of the trade space. So, if all of these could be met at the same time, that would be outstanding, but, again, trades. So, depending on what you project that future to be, there are trades.

The noise goal gets to the objectionable noise inside the airport boundary, and the emissions target, it is like the N+2, but it addresses contrails or additional global warming concerns.

From fuel burn, more reduced drag. You always want to reduce drag, but it also introduces the idea of alternative fuels. This says non-fossil fuel sources. We have, frankly, been deliberating on what is the right wording there, and that is probably why we are here. We want to get input from people on tweaking some of these.

The performance field length. In the handout, you see there is a baseline mission, and then there is a

sole mission that cuts the field length in half. That is to try to force a look at the metroplex idea, which is taking advantage of shorter runways at the bigger airports and regional airports in metropolitan areas that could handle vehicles, not the cornfield-type airports, but around metropolitan areas. That is what we are trying to convey there.

This is quite wordy. A lot of it is all in the handout at some level. This really addresses Phase 1. So scope, the first thing, this is putting yourself in the context of 2030-2035. Describe the challenges that may be facing the commercial aircraft operators in that time frame. Within that time frame, identify vehicle concepts and the enabling technologies to address these challenges, and the N+3 system metrics we got.

Trade space. Perform the trades. Convince us the context you are using is a good one. Convince us that the technologies that you are proposing are realizable in this time frame. Identify pros and cons. Quantify the noise, emissions, and performance. Juan mentioned the plus or minus 10 percent to be credible. I think in addition to that, the next obvious question, people can say it is plus

or minus 10 percent, and so we ask you to state your confidence level, however you would do that, plus or minus 10 percent, but "I am 20 percent sure" or "I am 95 percent sure," and however you do that. I am not sure how to do that, but it at least forces you to think about it and put something down, and then to assess the environmental, economic, and mobility impacts of introducing such a vehicle into the airspace, then recommend and prioritize the concepts in enabling technologies, define follow-on technology road maps, and provide the contractor report for public release.

At the end of Phase 1, you will have a plan that should be your proposal for Phase 2 where I would envision you would have refined your primary vehicle concept, and ideally, we would be able to do technology ground and/or flight experiments on who knows what may appear to be low-hanging fruit or what may appear to be the tall pole, whatever. That is up to you to propose, but we envision starting right away in Phase 2 on working towards this next concept.

My last chart, this is just since the previous one was pretty wordy. The key points, it is commercial.

We are not looking for a military vehicle. We recognize there will be dual use. It is this 2030-2035 time frame. We definitely want vehicle-centric studies, and you have heard that before today. So we don't want to go off and invent a new airspace system, but definitely, we have to have your contexts. There is a range of contexts, a range of futures you could put your vehicle in that are viable.

I mentioned this earlier, too. My way of thinking about this is what will be the most prevalent vehicle in the fleet beyond 2030, starting to introduce into service in 2030 and by the middle of the century.

A cursory assessment of the impact of the vehicle into the fleet, how is it going to change the system above the vehicle, the entire airspace system, enabling technologies and road maps, and by all means, use this as a clean sheet of paper. We often start with existing configurations and make derivatives, add a flow control, tweak something here or there.

This is a clean-sheet-of-paper approach. Think outside the box, and we are really excited. I am really interested to see what sort of ideas come out of this, and we have been very intentional in not trying to seed the

group with ideas. So that is why you don't see any of that.

That is all I had for now, and if there are any particular questions now, I can try to answer them.

ATTENDEE: Mike Harris in Aviation Management Research.

I was a little disappointed when I looked at the performance trade space that you didn't specifically zero in on approach slope, glide slope, because of the benefits of reducing the lateral spacing on arrivals, the ability to stack, in essence, two on top of a display threshold. You capture it with field length, but your field length is principally built around departures as opposed to arrivals.

So you may want to go back and consider adding trade space that, in essence, doubles the glide slope that we currently have.

DR. ALONSO: Can I help you with that one?

DR. WAHLS: Yes, you can.

DR. ALONSO: One of the things that maybe I should have mentioned and I forgot to say is that the Airspace Systems Program actually just concluded the proposal submission phase for a solicitation that is

looking at a number of events, aircraft concepts, and how they are introduced into the airspace, and some of these traits that you are discussing I imagine will be part of some of the proposals. We can't talk about it because the proposals just came in yesterday, but this NRA from the Airspace Systems and the N+3 are going to be going on somewhat simultaneously and in parallel with a lead time, I would say, of about five months or so for the Airspace Systems one.

So one of the things that I had written down that I didn't mention in my talk is that we are going to encourage the successful participants in the N+3 NRA to actually interact more closely with that group since that is some of the things that you are considering or put into the context that Rich was discussing before, but valid points.

DR. WAHLS: Well put.

ATTENDEE: Thank you, sir.

DR. WAHLS: Our next speaker is Peter Coen, the PI for the Supersonics Project.

Details of Supersonics Portion of the Solicitation

MR. COEN: Thank you, Rich.

As mentioned, I am here to present the supersonics perspective for the N+3 NRA. It is great to see such a big audience here, and I am glad that I did include a couple of slides that explain a little bit about what the Supersonics Project is because there are some folks I haven't talked to recently.

The Supersonics Project is all about developing knowledge capabilities, technologies that ensure the mastery of supersonic flight, flight in the supersonic regime, so one of the many regimes of flight.

Naturally, that includes aircraft, but it also includes other things. So just a reminder, the Supersonics Project does not just address aircraft. We also include an element that looks into the future and tries to develop the tools and technologies that will support things such as entry, descent, and landing on other planets with higher masses than have previously been landed, but today, we are here to talk about aircraft.

So, when we put together our project, what we were trying to do is identify those technical challenges that are unique to supersonic aircraft. There has obviously been a lot of overlap between the basic

fundamental technology that we work on and what Rich and the subsonic fixed wing and subsonic rotary wing and hypersonics projects work on. So, to help us clarify our work, we chose to work on supersonic commercial aircraft and entry, descent, and landing systems for human missions to Mars, and again, we tried to organize ourselves such that we work on the things that were distinct to supersonic.

So our challenge is we have chosen to look at efficiency, environment, performance, and also the integration, including multidisciplinary analysis, design, and optimization that will enable us to put together the pieces in a way that is overall most beneficial.

So, for efficiency, obviously we are looking at improving supersonic cruise efficiency and developing materials and structural systems that will enable us to have light-weight durable airframes that can survive at higher temperatures than the subsonic aircraft are exposed to.

Obviously, if you look at the past programs that have addressed development of supersonic aircraft, the environmental challenges for such an aircraft are very

large. Airport noise, we have to get an aircraft that has noise that is not more objectionable than the subsonic aircraft in the airspace that they operate in with a propulsion system that can be markedly different from those aircraft. In other words, it has to meet their goals of cruise efficiency, so, again, an opportunity for integrated design.

Sonic boom is obviously a showstopper for supersonic aircraft. In order for them to be widely acceptable, we consider that overland supersonic flight would be required. So we have to understand how to reduce that sonic boom. We also have to understand how that boom propagates, how to predict it, and how it interacts with people and structures on the ground.

For the near-term elements of our project, our performance challenge primarily addresses making the aircraft safe and comfortable for the crew and the passengers in all flight regimes, and primarily, that looks at the interaction of the control system, the structure, the aerodynamics, and even the propulsion system in what we call the aero-propulso-servo-elastic problem in terms of the analysis and design, and that is you have got a vehicle

that is long and slender. It tends to respond to the atmosphere in such a way that it can have flutter, gusts, or handling quality and ride control problems which need to be addressed in a manner that is synergistic with the overall design, that does not produce an excessive weight of performance penalty.

The one I have grayed out there is our technology challenge related to EDL, but again, a principle challenge that we look at is how do we achieve the solution to all the three efficiency, environment, and performance challenges in a way that is synergistic, how do we integrate and exploit the interactions between the different challenges and the different components of the aircraft.

So what are our objectives for the Supersonics Project in this N+3 study? Again, Juan has fairly much stated this, but I am going to just say some things in a slightly different fashion.

We are looking at what are some highly innovative approaches that are required to make supersonic flight more broadly available to the general public. That is what NASA is all about, as was mentioned, is the public good, what

benefit to the taxpayer.

So, if we are doing that, what are the key technologies, development needs, in terms of tools, technologies, and capabilities that will enable the development of such an aircraft, so we can incorporate this long-term thinking into our project's technology portfolio.

And a third reason really is to generate some excitement. Unfortunately, the models got stuck over in the corner there, but in the recent past, the Supersonic Project has been looking at putting together some pieces for a vehicle, for a more nearer term, our N+2 type of capability, and it really was exciting. People look at an aircraft. They can see where their piece fits in. They get excited about suggesting new ideas for their piece, and they get excited about seeing a product. So one of our key things in this activity is to generate some excitement about what a supersonic aircraft would look like if it was a supersonic airliner.

Fortunately, Rich and Juan have introduced you to the logistics of this chart, but this is our look at what the system's level requirements might be for the N+1, N+2, and N+3 supersonic aircraft. We have adopted that notation

from Rich and company, but really, there is no N aircraft right now for supersonic. If you keep up to date on what is going on in the trade press, there is obviously a group of folks out there that feel they are very close to having the technology in hand to launch a product which will be a supersonic business jet, for introduction into service in the 2015 time frame. That is a 1.6 Mach number airplane, 4,000 nautical miles, 6 to 20 passengers maybe, depending on the configuration.

Sonic boom. Depending on how they do their market, they are either going for a supersonic overland flight or not, but if they do, that requires a substantial reduction in the sonic boom noise level. The aircraft has to be compatible with the current noise regulations or the noise regulations projected for the 2015 time frame.

Cruise emissions. It is a small aircraft. It can probably get away with mission levels in terms of NOx, and I realize now that I did not talk about emissions on my previous chart. Where we distinguish ourselves in emissions is not so much on takeoff and landing, but since the supersonic aircraft tends to cruise at an altitude where the ozone is concentrated and has a higher potential

impact on the ozone layer, we are looking at the high altitude emissions problem for the supersonic aircraft, but again, since the fleet for the business jet will probably be small, maybe it will be okay to be equivalent to subsonic aircraft in terms of LTO NOx. The jury might be still out on that. We used the fuel efficiency of that vehicle as our baseline.

For the N+2, we are talking about a small supersonic airliner, something on the order of, say, 35 to 70 passengers, maybe a business class configuration, but again, a Mach number of 1.6 to 1.8 capability of flying supersonically over land, without disturbing people on the ground, again, the 2020 time frame, so with takeoff and landing noise equivalent to that of the subsonic regulation at that point in time.

Emissions index in terms of grams of NOx per kilogram of fuel, less than 10 to have no measurable impact on the ozone layer, but what about other sources of emissions, particulates, and water vapor? Those will probably need to be addressed as the fleet size for this vehicle grows larger, and we are looking at consideration of a 15 percent improvement in fuel efficiency over our

baseline.

For the vehicle that is the focus of this study, the N+3, our vision is a vehicle that might be efficient at multiple Mach numbers because it will be constrained in some cases to fly at speeds that aren't optimal or aren't its highest attainable speed, so maybe an aircraft that can fly a Mach 2 or greater in unrestricted flight corridors, but in order to achieve low boom, because of its size, it might have to slow down a little bit and fly the 1.6 to 2.0 speed range, longer range, up to 6,000 nautical miles, and passenger capability of carrying a selection of passengers from business class to economy class.

Again, the boom targets will be required to be met if the aircraft flies over land. For over water, it might be able to accelerate to a higher speed and have a less restricted boom level. Again, substantial noise reductions. Again, more stringent restrictions on NOx emissions, again, because of the fleet size as it grows, and also, we will continue to need to address water vapor, particulate, and other emission sources, and again, highly efficient in terms of its fuel burn to enable economic operations.

Across the bottom, you see some images of the N+1 business jet, our concept for an N+2 small supersonic airliner, but again, for the future, it is 'put your concept here.' We are really interested to see what can be done that has been different from what has been done in the past.

At the risk of seeding the ideas to the audience, I will leave you with some potential N+3 configuration features.

Primarily, for the N+2 configuration, we look at highly integrated design as being a solution. For the N+3 configuration, we really consider that unique, new technologies that work well in an integrated fashion will be required to make that vehicle reality, so integrated design for low boom, but perhaps with some sort of particular sonic boom reduction device that works well in an integrated fashion. I won't wander around the whole aircraft, but cruise efficiency, including morphing geometry, highly efficient propulsion components which may use alternative fuels, extremely low emissions of, say, NOx, and also lower emissions flight profiles which can minimize water vapor.

So, with that, the scope of our study and the key points of our study are very similar to the things that Rich pointed out. We are looking for people to explore the design space, to help us define the requirements set for this vehicle. You will notice I did not say "corners of the trade space." I don't know if our initial cut on requirements defines the corners of the design space, but this study will help us do that, and we are looking for out-of-the-box thinking.

So, with that, I will take questions. Please use the microphone if you can.

ATTENDEE: Just very quick, why did you use the SST as a baseline?

MR. COEN: It is 1950s technology. Really, there is a technology set that is considerably beyond where that vehicle was that does meet some of our requirements that is available now and being explored.

We have had that debate, but we have elected to try to find something that is a little bit closer to what the subsonic vision as their in-service aircraft.

DR. ALONSO: Do you mean HSR versus --

ATTENDEE: I mean the Concorde.

ATTENDEE: I have a question. You talked about the commercial concept in the high advanced range or system, but it sounds like for this, you are not interested so much in the high advanced range or system as you are the --

MR. COEN: No. This is strictly advanced commercial aircraft.

MS. CRISP: Okay. If there are no more questions for Peter, we will move to the next item on the agenda.

Q&A Period

ATTENDEE: Dick Miles from Princeton.

It just seems to me, Peter, the big issue here is going to be safety, and you didn't really highlight safety so much in your discussion. I wonder if it would be worthwhile talking a bit about goals that you might have regarding safety, operational characteristics, the tradeoffs that would be important for having a safer system.

MR. COEN: I didn't really consider that there would be any tradeoffs relative to safety. The supersonic aircraft must be as safe to operate and fly in as the subsonic fleet.

DR. ALONSO: Let me try to address that as well and give an answer that is similar to the one that I gave before. Although you don't hear safety or airspace here highlighted specifically, we want to put the new vehicles in those contexts.

If you read the national policy, it will say that safety is paramount, and that needs to remain true for the vehicles that you are putting together as well.

Now, there may be issues of safety related to the vehicle by itself, which obviously need to be considered in the conceptual design study. There may be a number of safety issues that are related to the operation of these vehicles in the airspace, and that is where I would like to put the plug again for this other parallel study which I said the proposals were due I think yesterday, where we were asking precisely those questions.

So one of the efforts that I would like to see come to fruition is that this study and the proposers that successfully get an award out of the Phase 1 study actively participate in the out-briefs and some of the review meetings that the other study will have because some of this stuff, the safety issues, will be looked at in those

contexts, maybe not with the specifics of the operations of certain vehicles that are being done here, because it is a bit behind, but certainly within the context of multiple types of vehicles, like supersonic, subsonic, different approach paths, short takeoffs and landings, so on and so forth.

ATTENDEE: I am David Daws from Northrop Grumman in El Segundo, California.

We noticed with some of the NRAs in the past, they tended to be more in the research side. They favored universities or small businesses or those types of things. With the larger dollar values we see for this, does NASA envision -- like with the teaming and collaborative arrangement that we would pursue, does NASA have any conceptions of whether it would be an industry-led team versus a university-based team or any type of leadership from those perspectives?

DR. ALONSO: In the NRAs, I think if I may answer your first statement, it is a bit of a misconception that the NRA has been mostly academic institutions. The Fundamental Aeronautics Program in the last year and a quarter has had 10 solicitations. The first round for

solicitations was probably 65 percent, even 70 percent universities versus 30 percent industry, but the last four have those roles reversed. It has been mostly industry with some participation from academic institutions in terms of the dollar values that are being awarded.

As far as this solicitation is concerned, we are not making any sort of preconceived ideas of who will be a successful winner. On the other hand, you do have a 12-month period where you have to do a significant conceptual level study. So we are obviously going to look at the credibility of the institutions that are going to be proposing in making decisions as to who actually gets an award. So you have to demonstrate to us whether you are a university team or an industry team or a combination that you are able to do the job that we are asking you to do in that period of time.

ATTENDEE: Is cost sharing going to be a requirement?

DR. ALONSO: The question is: Is cost sharing going to be required? No, there is no cost-sharing requirements.

On the other hand, we are asking for certain

things. We are going to provide a certain amount of funding. If the participants want to cost-share in some way, is that something that is allowable? I know Gene Johnson is back there, and he is our procurement person, but it is not a requirement for the solicitation.

DR. PORTER: It is not a requirement.

Please come up to the mic and ask questions.

ATTENDEE: Craig Collier with the HyperSizer Automated Software for Structural Sizing.

I had two questions. The first question is, can the panel kind of elaborate a little bit more on the category of the subsonics? Can you further define the three vehicles to something a little bit more particular as far as passenger class, weight class?

DR. ALONSO: For N+3?

ATTENDEE: Yes.

DR. ALONSO: In your handout -- well, Rich, I will let you answer that since you guys put together that.

DR. WAHLS: For the N+3?

ATTENDEE: Yes.

DR. WAHLS: We put 737 in, very specific 737 vehicle in there as a reference, as a reference marker, and

we want to be able to compare back to it, but in the advanced concept, we want to allow the freedom to go away from that. If you put yourself in the 2030 time frame, if the prevalent, the most required vehicle size is bigger or smaller, we want to know that, then you have to be able to somehow reference that back to what a 737 and probably a 737 with a certain suite of advanced technology put on it would do in that time frame. So there is freedom.

ATTENDEE: Okay. I remember that PowerPoint you showed where it is up to the proposer to decide what he thinks would be the sweet spot, I guess.

DR. ALONSO: We are giving you a reference mission. I wouldn't want to reference the 737 because that is the baseline that we are using for those improvements, but we believe that you are going to require some significant changes in engine cycles and significant changes in the actual configuration of the aircraft if you are going to have a chance to achieve some of the goals that you see there.

I think I understand what Rich was trying to say, but we are not looking for a souped-up 737.

ATTENDEE: Right, I understand.

DR. WAHLS: No. No. But the reason it might have sounded like that is I know in a lot of system studies related to hybrid-wing bodies, the question always comes up when people talk about they do a study on the winged body and it has got this much benefit, and the naysayers come back and say what are you comparing it to. Oh, well, if you added this composite or that as wings evolved, they would be about the same, some people will say, and other people say no, but that is what I was trying to convey.

ATTENDEE: Okay.

DR. WAHLS: I want to be able to have that answered succinctly as we can up front.

ATTENDEE: The next question is a little bit more dear to my heart. How much fidelity in the results is expected? For instance, if part of the product may be a mass statement and then in that mass statement would be some kind of explanation of how those weights were established, would that include as far as going down, making a finite element model and actually getting the external loads from CFD and applying it to that model and doing some kind of not historical weight predictions, but something a little bit more physics based, let's say?

DR. ALONSO: It is funny you ask that question because we had this discussion multiple times in trying to formulate what it is that we wanted to ask. I think the best answer that we came up with is that we do want the sort of first-order drivers to be nailed down within those error bands that we were talking about earlier, with the confidence in those results provided by you. We do expect that if there are some specific areas of your proposed concept that do require that higher fidelity, maybe some CV loads, maybe some final model, that you would actually provide that as a result of the Phase 1, but we are leaving it up to you to determine where you have to invest that extra level of effort to actually increase the credibility of the product you are producing.

ATTENDEE: Okay.

ATTENDEE: Om Sharma, UTRC.

Is the focus of these studies North American and European-centric? Because a lot of the future sales are probably going to have them away from this market, and new solutions can come in that area. What are your thoughts on that?

DR. ALONSO: A strong motivation for this whole

thing is the growth, and we mentioned NextGen, so on and so forth, which it is somewhat focused on the U.S., is actually trying to come up with solutions that interoperate with the whole international airspace. I would envision that in addition to the applications here in the U.S., these will be applications that will be seen around the world.

ATTENDEE: Peter Hollingsworth, Georgia Tech.

Given the environmental focus and the fleet level aspect, is NASA open to looking at some more sophisticated environmental metrics beyond just LTO NOx and straight fuel burn and noise?

DR. ALONSO: I would say yes, but I will let both Peter and Rich comment on that.

MR. COEN: I would say that we would be. Particularly in the supersonics area, we are looking to define an adequate metric or metrics that help us judge the environmental impact of high-altitude aircraft.

DR. WAHLS: I would say we would be, but if that is all you propose, then --

ATTENDEE: Obviously, what the vehicle concept is, just in place of those potentially.

DR. WAHLS: Yes.

MS. CRISP: Again, can you remember to write down your questions, so that we can have them submitted?

ATTENDEE: I am Larry Moody with Boeing Phantom Works.

A quick question. Are you interested in any personal transportation concepts as part of this?

DR. ALONSO: That was not within the scope of the types of vehicles we were looking at. When you see the full solicitation and you read through that little summary, you would see that fixed wing is suggesting a 160-passenger type of vehicle, with some leeway, depending on what your projection of what the future may look like, but not down to four, and similarly for supersonics.

ATTENDEE: Thank you.

ATTENDEE: My name is Quentin Smith. I am with SAIC.

You talked about NextGen as kind of the opening of the program, but then you kind of talked about emission standards up to date. My question to the group is, although you say think out of the box, are you considering the certification and operational requirements are going to

be necessary to get these vehicles into the NAS, PART 25? Are you asking the group to go beyond that? Are you asking the group to do something that is going to require a change in PART 25?

DR. ALONSO: Your question is -- are we asking you to anticipate what the regulatory environmental will be?

ATTENDEE: Yes. Because if you are going to operate these on a regular basis, particularly in a revenue service, there is certain criteria that are going to have to be met, specifically along the lines of safety. So I am just wondering if you are asking the group to challenge the existing regulatory structure, are you asking them to work within the structure, or is it a combination of both. Have you thought about that?

DR. ALONSO: I would say [inaudible] because I think this is a good question.

ATTENDEE: This is a good question to them because there have been a lot of energy and effort into it. You have a difficult problem in getting it to move forward if you can't get the regulatory structure that it needs to meet you halfway.

DR. ALONSO: I would say just off the cuff that I will write this question down, and when we publish the questions and answers, we will put it on the web, when we will have a chance to think about it more.

While the focus of the solicitation is not in anticipating regulatory changes, so on and so forth, or what the regulatory environment may be in that time frame, I think use of historical trends for things that have happened in the past and using additional information with the projections that you saw for the NextGen, for the U.S. in particular, and trying to make informed choices is probably a good idea, that I did not think of as the focus of this particular effort.

DR. PORTER: I will answer that, and I agree that is a very thoughtful question. Certainly, the focus here isn't to try to rewrite regulation or necessarily directly influence it. On the other hand, part of what we see as our role in NASA is by bringing these ideas forward now and positioning them, if you will, in the greater NextGen context, and we work very closely with the FAA, as you know.

ATTENDEE: Certainly, yes.

DR. PORTER: We enable people to start thinking about this now, while it is still on paper, while people are still being willing to put ideas out there for strong consideration. So, hopefully, you will get to influence that thought process early and prepare folks for what is coming and then prepare to think about how to potentially change or influence that process.

ATTENDEE: Well, it is a very good system now.

DR. PORTER: Oh, it certainly is. It certainly is.

ATTENDEE: The performance and the day-to-day basis --

DR. PORTER: Absolutely.

ATTENDEE: -- I mean it is phenomenal. We are victims of our own success.

DR. PORTER: Absolutely.

ATTENDEE: So, from the standpoint of what you are offering today, I would just ask you to frame it around that, and also the fact that even though you are going to have the operational approval requirements continue in this aspect, you are going to have to look at it. Still, even the bigger piece is going to be the emissions piece because

of the environmental part of it, the NOx, the emissions, those kinds of things, you are right. So I just wanted to bring that to the attention to the group and get your perspectives on it. So I thank you.

DR. PORTER: Absolutely. Good question. Thank you.

ATTENDEE: Hi. I am Jack Langelaan from Penn State.

Air cargo doesn't seem to be addressed here directly, although, arguably, it is very important commercially. I mean, Internet shopping would be dead without air cargo.

I suspect that emissions would be pretty different for an air cargo-type vehicle. Is that going to be addressed in a future NRA, or is that outside the scope of NASA commercial?

DR. WAHLS: Today, a lot of the cargo vehicles are passenger vehicles turned into cargo, and we do say in here passenger- and cargo-carrying or package-carrying. So payload, it would be people or packages. There would be a lot of them flying. So that is part of the fleet makeup.

ATTENDEE: If you make a trade between flying

something very slowly or very efficiently, then it will be great for cargo, but no one is going to want to wait 60 hours to fly from Tokyo to L.A.

DR. WAHLS: I would think about it not in that specialized a vehicle.

ATTENDEE: Okay.

DR. ALONSO: You were talking about sort of lighter-than-air type of concepts or partially lighter than air. That is not the focus of this solicitation.

Will we think about it in the future? At the moment, we don't have plans to do that. I wouldn't preclude it, but it is certainly not the focus of the current one.

ATTENDEE: Thanks.

MS. CRISP: Any more questions for the panel? One more. Oh, two more.

ATTENDEE: Gerry Brines from Rolls-Royce North American.

I would suggest in your goals establishment, where you say CFM-56/737 as the baseline, there are many 737 models, a lot of different CFM-56s. I would suggest NASA state a level representative of that airplane, but

don't leave it up to the various study contractors to try and determine what that number is.

DR. ALONSO: We tried to be -- not in the slides, but it is a 737/800 with a CFM-56/7B/27, I think. We were much more specific.

ATTENDEE: Well, even if you are more specific, I still suggest to you say what you think that value is for it.

DR. ALONSO: Yes. We certainly can provide that.

In that context, while it is important, I think we can do this and provide that baseline performance that we think is the reference for some of the targets that we are addressing. I will just ask everybody to remember that these targets in the N+3 column were labeled at least in one of the charts as "corners of the trade space," and then we had said multiple times that where we are looking is not just to accomplish all of those and just barely that, but rather to look at trade studies, so they are used as guidance. A percentage point in performance is probably not something that is going to get a proposal selected and another one not selected.

ATTENDEE: Bob Liebeck, Boeing, MIT, UCI.

At any rate, I am hearing, I think, "out of the box." I suggest that a conventional configuration still be studied. Your own Dennis Bushnell regards anything with an aspect ratio of lower than 50 as untenable. So I think there is a lot of gold to be mined there, and just because the primary configuration is a tube and wing, I think there is a lot to be done there.

I have got some good ideas there I think myself.

DR. ALONSO: Let me clarify. When I was saying significantly change the configurations, Dennis Bushnell was sitting back there, and I agree that a significantly higher aspect ratio, however you want to structure and raise the wings, et cetera, et cetera, is certainly a model, and I would consider that a quite radical departure from the types of things we are doing.

ATTENDEE: All right.

DR. ALONSO: Thanks, Bob.

MS. CRISP: Anybody else?

[No response.]

Next Steps

MS. CRISP: Okay. I think we are at a last call. So the next item on the agenda is actually Next

Steps which is going to talk to the schedule, which you are probably interested in. Given that Dr. Alonso said we want to see awards by the summer, the question is what has to happen between now and then.

The first step is everyone needs to register to the NSPIRES system, and how do you do that? You do that through access of the www.Aeronautics.NASA.gov website.

When you log into the NSPIRES, when you register there, please make sure that you refer to our NRA, and that is stated there.

So, as we said, our intent is to go back, think about all the questions you have asked and the information that has been derived from that, include that as we expand our solicitation, and actually get that solicitation out on the street, shooting for the middle of January.

We are asking the proposals be returned within 45 days. So we hope you are thinking about it now, and you have got, gee, your holidays coming up. I am sure you will have plenty of time sitting on a back porch with a glass of wine. You can get something going.

After the 45 days, we are actually even giving ourselves a very tight schedule then to review those same

proposals, and we hope to have completion of that by the middle of April, and we will make announcements within a week after we have made selection. So, between April and summer, that is the negotiation period. So that is why we say awards do not occur until probably the summertime.

In closing, I really just want to take a moment and thank our staff, Leslye Mogford and Karen Rugg and Humphrey Crockett and Lillian Gipson, any number of others, for helping us put on this conference. Without them, it could not have happened. Those same people will be supporting you in the breakout sessions after completion here, if you have signed up for that activity, and the rooms can be found as you leave this auditorium. Take a left. Take an immediate right where the sign is that looks like NASA and go up the stairs, and the two rooms are right at the top of the stairs, but please make sure that you have signed up, if that was your intent, for subsonics or for supersonics, and those forms still remain at the registration table.

DR. ALONSO: If I may make some comments. If you go to www.Aeronautics.NASA.gov that Dr. Porter mentioned, on the left-hand column, I believe, there is a little

button that says ARMD NRA. That is your access point for the information, for this particular NRA solicitation and other solicitations that may be forthcoming in the future.

So, either tomorrow or Friday, we will try to have Dr. Porter's and my presentation up on that particular website that you can reference from there. Shortly thereafter, the fixed wing and the supersonics ones, and then by the end of next week, we will actually have the entire transcript of what has gone on here, in case you want to either review some of the discussions or you want to share the information with colleagues that may not have been able to make it here.

MS. CRISP: And we are making the participants list, those that approve it, available.

DR. ALONSO: When you register, if you checked the box that you did not mind your contact information to actually be disseminated in order to encourage some of these teaming arrangements, we will actually publish on that very same website a list of participants in this pre-proposal conference.

MS. CRISP: With that, I want to thank all of you for coming.

[Applause.]

[End of Pre-Proposal Conference.]

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